We claim:

1. A polarization transformer for DC drift-free polarization transformation or polarization mode dispersion compensation, comprising:

a chip having a waveguide with an input;

a plurality of comb-shaped mode converter electrodes disposed perpendicularly to said waveguide, said mode converter electrodes receiving control voltages for changing a state-of-polarization or a PMD of an optical signal;

a comb-shaped ground electrode disposed in vicinity of said mode converter electrodes; and

a device selected from the group consisting of a differential phase modulator and a mode converter at said input.

2. The polarization transformer according to claim 1, wherein said waveguide has an output, and another device selected from the group consisting of a phase modulator and a mode converter at said output.

3. The polarization transformer according to claim 1, wherein at least one converter cell is defined on said chip, said converter cell comprising several comb-shaped converter electrodes running perpendicular to said waveguide, and a comb-shaped ground electrode.

4. The polarization transformer according to claim 3, wherein said converter cells include TE-TM converter cells having two mode converter electrodes with varying spaces between mutually adjacent mode converter electrodes.

5. The polarization transformer according to claim 4, wherein said TE-TM converter cells comprise two mode converter electrodes, and wherein two teeth, one of each of said two mode converter electrodes, are placed between two teeth of a respective said ground electrode.

6. The polarization transformer according to claim 4, which comprises further differential phase modulation devices disposed between said converter cells.

7. The polarization transformer according to claim 1, wherein said chip is a lithium niobate chip with at least approximate Y propagation.

8. The polarization transformer according to claim 7, wherein said chip is a lithium niobate chip with at least approximate X cut.

9. The polarization transformer according to claim 7, wherein said chip is a lithium niobate chip with at least approximate Z cut.

10. The polarization transformer according to claim 1, wherein a differential phase shifter comprises two electrodes running on either side of said waveguide.

11. A polarization transformer for DC drift-free polarization transformation or polarization mode dispersion compensation, comprising:

a chip having a chip surface, a waveguide with an input, and a plurality of comb-shaped mode converter electrodes receiving control voltages for changing a state-of-polarization or a PMD of an optical signal;

a device selected from the group consisting of a differential phase modulator and a mode converter at said input; and

electrodes on two sides of said waveguide for generating electrical fields along said chip surface running perpendicular to said waveguide.

12. The polarization transformer according to claim 11, wherein said waveguide has an output, and another device selected from the group consisting of a phase modulator and a mode converter at said output.

13. The polarization transformer according to claim 11, wherein at least one converter cell is defined on said chip, said converter cell comprising several comb-shaped converter

electrodes running perpendicular to said waveguide, and a comb-shaped ground electrode.

14. The polarization transformer according to claim 13, wherein said converter cells include TE-TM converter cells having two mode converter electrodes with varying spaces between mutually adjacent mode converter electrodes.

15. The polarization transformer according to claim 14, wherein said TE-TM converter cells comprise two mode converter electrodes, and wherein two teeth, one of each of said two mode converter electrodes, are placed between two teeth of a respective said ground electrode.

16. The polarization transformer according to claim 14, which comprises further differential phase modulation devices disposed between said converter cells.

17. The polarization transformer according to claim 11, wherein said chip is a lithium niobate chip with at least approximate Y propagation.

18. The polarization transformer according to claim 17, wherein said chip is a lithium niobate chip with at least approximate X cut.

19. The polarization transformer according to claim 17, wherein said chip is a lithium niobate chip with at least approximate Z cut.

20. The polarization transformer according to claim 11, wherein a differential phase shifter comprises two electrodes running on either side of said waveguide.

21. A polarization transformer for DC drift-free polarization transformation or polarization mode dispersion compensation, comprising:

a chip having a waveguide conducting an optical signal;

at least one first polarization transformer for changing a state-of-polarization or a PMD of the optical signal;

at least one second polarization transformer adapted to alternately and at least partly take over a function of said at least one first polarization transformer and to be driven by driving signals opposed to taking over the function.

22. The polarization transformer according to claim 21, wherein said at least one first polarization transformer comprises a plurality of first polarization control elements, said at least one second polarization transformer comprises a plurality of second polarization control elements, and a

number of said first polarization control elements equals a number of said second polarization control elements.

23. The polarization transformer according to claim 21, wherein said at least one first polarization transformer comprises between one and six first polarization control elements, and said at least one second polarization transformer comprises between one and six second polarization control elements.

24. The polarization transformer according to claim 23, wherein the number of first polarization control elements and the number of second polarization control elements equals four.

25. The polarization transformer according to claim 21, wherein one of said polarization control elements is a mode converter with endlessly variable phase difference between a mode-converted and a not mode-converted signal.

26. The polarization transformer according to claim 25, wherein one of said polarization control elements is a Soleil-Babinet compensator.

27. The polarization transformer according to claim 25, wherein one of said polarization control elements is a TE-TM mode converter.

28. A polarization transformer assembly, comprising a plurality of polarization transformers according to claim 21, and a plurality of polarization-maintaining optical fibers alternately connected in between said polarization transformers.

29. The assembly according to claim 28, wherein said chip of each of said polarization transformers has a defined crystal axis, and the principal states-of-polarization of said polarization-maintaining optical fibers correspond to said crystal axis.

30. The assembly according to claim 29, wherein each of said polarization transformers has an input and an output, and a respective said polarization-maintaining optical fiber is connected to said output of a respective said polarization transformer at least approximately at 0° with respect to a principal state-of-polarization, and to said input of a following said polarization transformer substantially at 90° with respect to said defined crystal axis of the polarization transformers connected by said polarization-maintaining optical fiber.

31. The polarization transformer according to claim 28, wherein said chip defines a surface of the polarization transformer and the principal states-of-polarization of said

polarization-maintaining optical fibers correspond to said surface of the polarization transformer.

32. The assembly according to claim 31, wherein each of said polarization transformers has an input and an output, and a respective said polarization-maintaining optical fiber is connected to said output of a respective said polarization transformer at least approximately at 0° with respect to a principal state-of-polarization, and to said input of a following said polarization transformer substantially at 90° with respect to said surface of the polarization transformers connected by said polarization-maintaining optical fiber.

33. The polarization transformer according to claim 21, wherein said chip is a lithium niobate chip with at least approximate Z propagation.

34. The polarization transformer according to claim 21, wherein said chip is a lithium niobate chip with at least approximate X cut.

35. The polarization transformer according to claim 21, wherein said chip is a lithium niobate chip with at least approximate Y propagation.

36. In combination with a PMD compensator of a receiving terminal, the polarization transformer according to claim 21,

wherein control voltages used as converter control voltages are generated by filtering and rectifying a baseband signal generated by receiving the optical signal.

37. The polarization transformer according to claim 21, which comprises at least one polarization beamsplitter at an output of said waveguide, said beamsplitter having outputs emitting mutually orthogonal signal parts.